

Crucial Component Damage Detection, Monitoring and Mitigation, Phase I

Completed Technology Project (2008 - 2008)



Project Introduction

This SBIR project delivers an on-board structural health-monitoring (SHM) system with embedded sensors that sense mechanical impedance deviations to flag incipient damage in time to recover from or prevent in-flight failures. This Component Damage Mitigation (CDM) system integrates early damage detection with failure recovery measures such as self-healing fasteners. Implications of the innovation Next Generation Air Transport Systems bring increasingly demanding weight and performance needs that encourage aircraft to operate relatively close to their design limits--minor structural failure can mean rapid catastrophe. On-board sensing, diagnostic, and damage mitigation capabilities are needed for early correction of incipient damage. However, no practical system exists. We address this deficiency by building on our existing SHM unit and incorporating damage mitigation. Technical objectives CDM leverages our work in impedance-based SHM. Our current prototype consists of a single custom electronics board, and is a TRL 5 unit. We have demonstrated field operation in Boeing launch simulation tests and on full-scale wind turbine blades. We propose to integrate our current approach with damage mitigation measures and to create a practical single-chip solution. We include computer modeling that generates virtual data in our sensor validation. Research description Phase 1 establishes feasibility for a single-chip approach based on the impedance method, and demonstrates damage mitigation on a model self-healing fastener. Phase 2 completes and validates single chip development, integrates damage detection and mitigation, and delivers an operational unit. Anticipated results Phase 1 demonstrates damage detection/mitigation integration and provides a detailed chip roadmap. Phase 2 delivers an operational unit that performs integrated damage detection, monitoring, and mitigation in crucial propulsion system and airframe components.



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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Glenn Research Center (GRC)

Responsible Program:

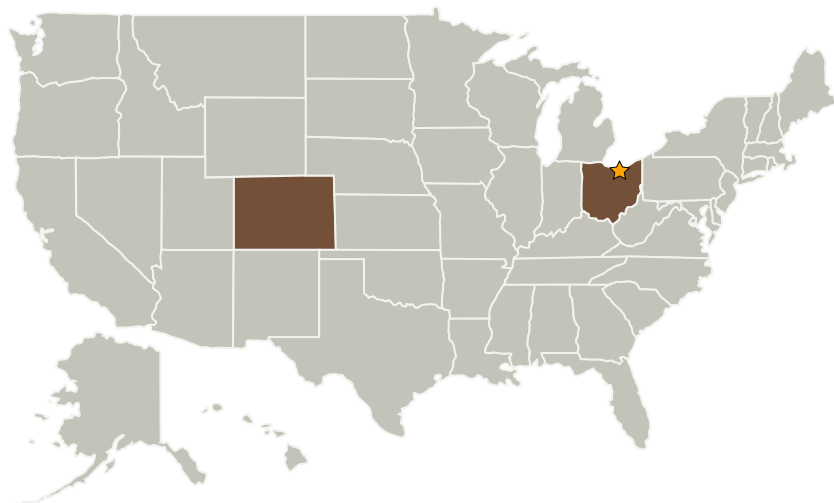
Small Business Innovation Research/Small Business Tech Transfer

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Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★ Glenn Research Center(GRC)	Lead Organization	NASA Center	Cleveland, Ohio
Extreme Diagnostics, Inc.	Supporting Organization	Industry	Boulder, Colorado

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Robert B Owen

Technology Areas

Primary:

- TX10 Autonomous Systems
 - ↳ TX10.2 Reasoning and Acting
 - ↳ TX10.2.6 Fault Response

Primary U.S. Work Locations

Colorado	Ohio
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